The Role of Combined Heat and Power in Illinois' Energy Future

Midwest Combined Heat and Power Initiative

Midwest CHP Application Center

October 1, 2002

Purposes of Today's Meeting

- Summarize the benefits of Combined Heat and Power (CHP), including meeting diverse consumer electricity requirements, energy conservation, and grid enhancement.
- Review policies that support CHP and Distributed Resources (DR).
- Discuss barriers to realizing the full promise of CHP and other DR in Illinois.
- Recommend changes to Illinois law and policy.

Working Together In The Midwest

Midwest CHP Initiative

- 7 State Energy Offices
- 2 State Commissions
- 3 Utilities
- U.S. DOE & EPA
- 7 Not for Profits

Midwest Cogeneration Association

(Over 150 members)

- Engineering Firms
- Manufacturers
- Owners /Operators
- Utilities

Midwest CHP Application Center

Partnership Between

University of Illinois at Chicago

Gas Technology Institute

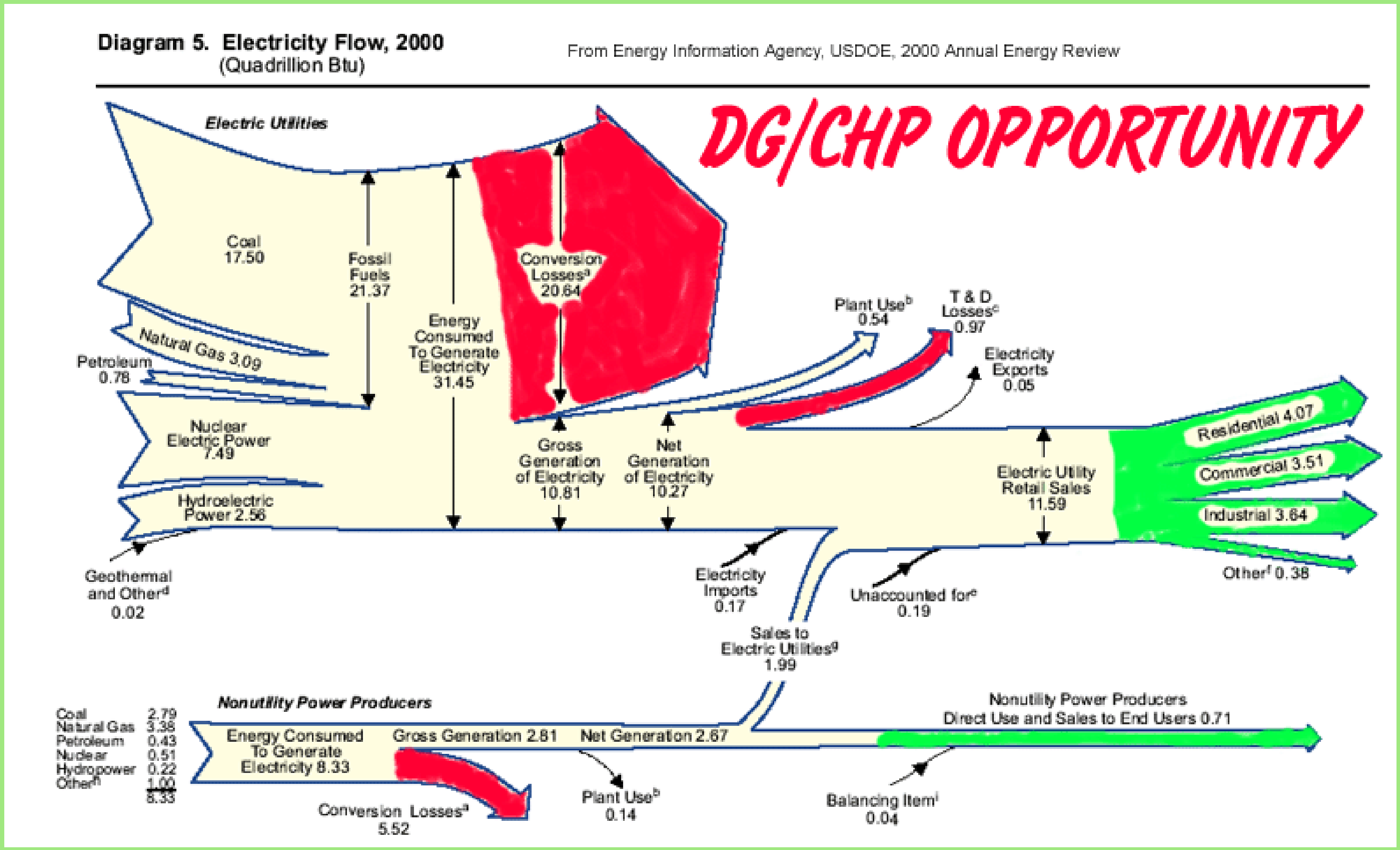
U.S. DOE

Combined Heat and Power

(a type of distributed resource)

- An *integrated* system located at or near the end-user that:
- Serves at least part of the electrical load, and
- Uses the thermal energy produced by the power source for:
    - Heating
    - Cooling
    - Dehumidification
    - Process heat

Can This Be True?



Why Now?

- Rising Concerns Over
  - Load Growth (EIA estimates 42% growth by 2020)
  - Power Supply Constraints (e.g., aging infrastructure)
  - Electricity Prices
  - Environment
  - Power Security
- Selected Power Outage Costs

Industry	Avg. Cost of Downtime
Cellular Communications	$41,000 per hour
Telephone Ticket Sales	$72,000 per hour
Airline Reservations	$90,000 per hour
Credit Card Operations	$2,580,000 per hour
Brokerage Operations	$6,480,000 per hour

Benefits of Combined Heat and Power to Illinois

High Efficiency, On-Site Generation Means . . .

- Improved reliability
- Lower energy costs
- Better power quality
- Lower emissions (including CO2)
- Supports grid infrastructure
  - Fewer T&D constraints
  - Defer costly grid updates
  - Price stability
- Facilitates deployment of new clean energy technologies
- Conserves natural resources
- Enhances competition

ICC Staff Comments on Distributed Resources Benefits (including CHP)

- *Consumers can "lower energy bills by installing DR applications."* (p. 5)
- *In growing communities, DR can "reduce the need for upgrades to existing distribution system equipment as load is shifted to other paths, which will lower costs to the system as a whole."* (p. 6)
- *"DR can effectively provide line loading relief for transmission and distribution lines by placing the generation source as close to the end user as possible."* (p. 6)

Source: "Distributed Resources: Report and Review of Comments to the Illinois Commerce Commission Electric Policy Committee" (March 2000)

CHP Technologies

Reciprocating Engines

Micro Turbines

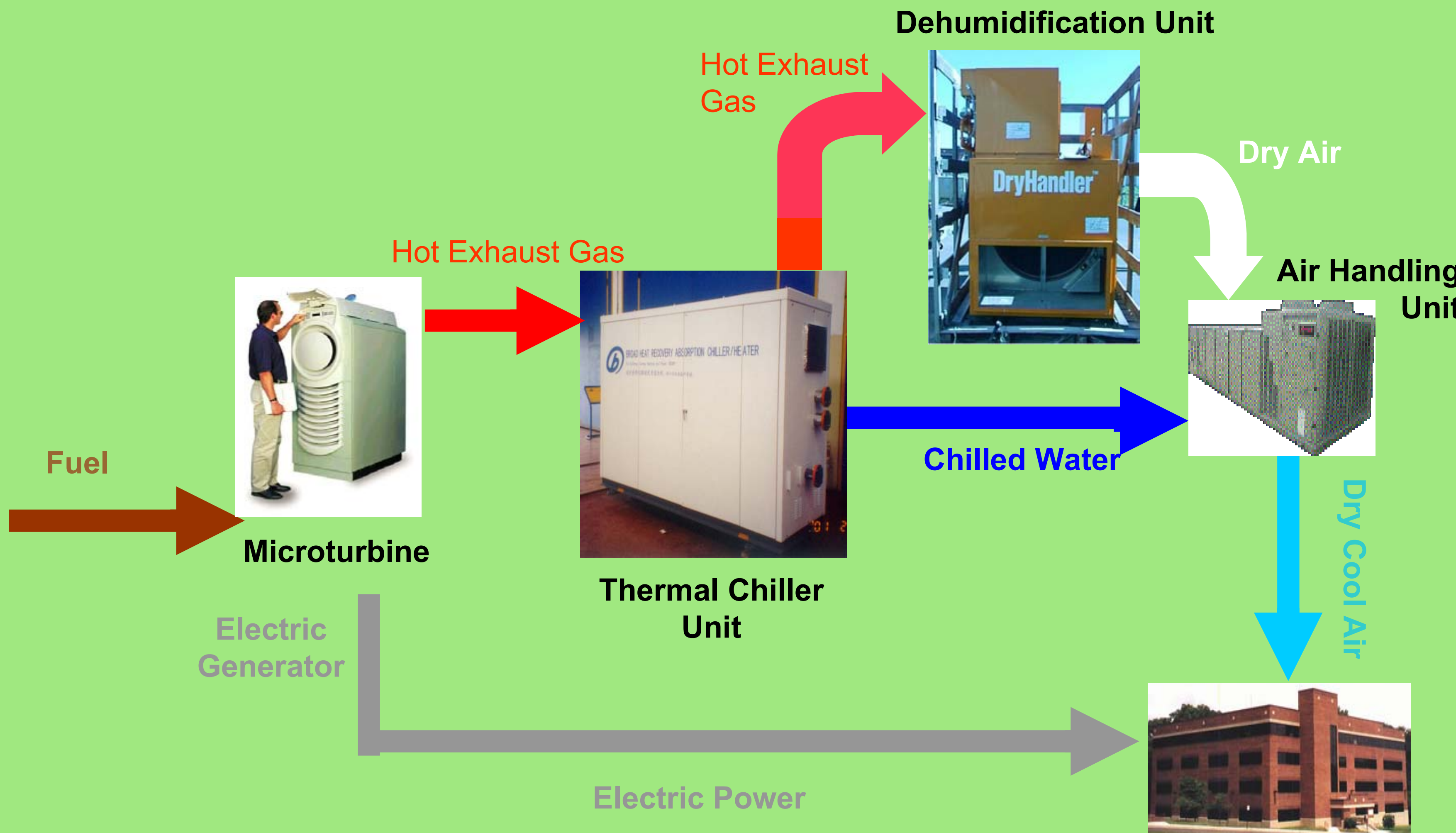
Fuel Cells

Absorption Chillers

Dehumidification

Thermal Storage

Typical Commercial CHP System



Example:

University of Illinois at Chicago

- 57.5 MW total in two systems
- $64 million cost
- Payback in 7 to 10 years
  - $2 to $7M annual savings
- Excess steam sold to nearby school
- Emission Benefits:

CO_2 ↓ 28.5% (29,545 tons/y)

NO_x ↓ 52.8% (126 tons/y)

SO_2 ↓ 89.1% (551 tons/y)

3.8 MW reciprocating engine at UIC's central heating plant

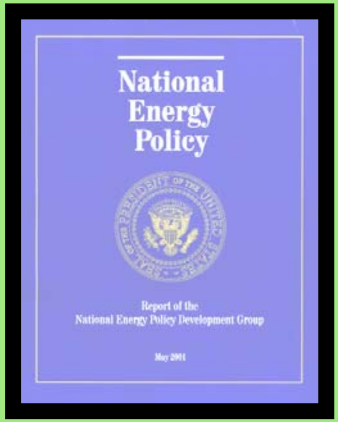
UIC System Details
(East and West Campuses)

- 7 reciprocating engines ranging from 3.8 to 6.4 MW each
- 3 turbine generators 7 MW each
- 7 exhaust gas heat recovery systems
- 2 jacket water heat recovery systems
- Several absorption chillers totaling 4350 refrigeration tons
- 3 electrical centrifugal chillers
- 3 boilers

Double effect absorption chiller

National CHP/DR Commitments

- **National Energy Plan**
  - Enact an investment tax credit
  - Promote use of CHP, especially in brownfields
  - Energy legislation to remove barriers
  - Permitting to reward efficiency gains



- **U.S. DOE CHP Challenge**
  - Double national CHP to 92 gigawatts by 2010.
- **U.S. EPA CHP Partnership**
  - Illinois members include Abbott Labs, Perma Pipe, Illinois DCCA, Chicago Department of Environment, Peoples Gas, GTI, UIC

ELPC's *Repowering the Midwest* (2001)

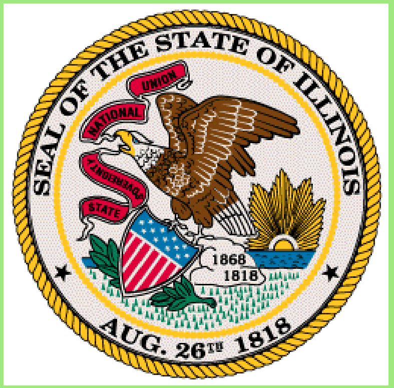
Report Findings

- Illinois has more CHP potential than any other Midwestern State: At least 2000 megawatts by 2010 and at least 4000 MW by 2020.
- "CHP has great potential for energy savings, economic benefits and environmental improvement."

Source: www.repowermidwest.org/plan.php

Illinois Energy Policy (2002)

Illinois should remove artificial barriers to Distributed Resources "in order to reduce peak system demand and provide demand flexibility for consumers. These barriers include *non-existent or inconsistent interconnection standards and procedures, unclear or discriminatory treatment of distributed generation rates and the lack of posted interconnection study fees, schedules and interconnection deadlines*." (Recommendation 19)



- State and stakeholders should develop statewide interconnection standards and procedures for distribution. (#20)
- State should continue to promote Combined Heat and Power and onsite generation projects. (#21)
- State should work with regional CHP groups to identify and overcome CHP and Distributed Resources market barriers. (#22)

Source: www.state.il.us/gov/energy/default.cfm

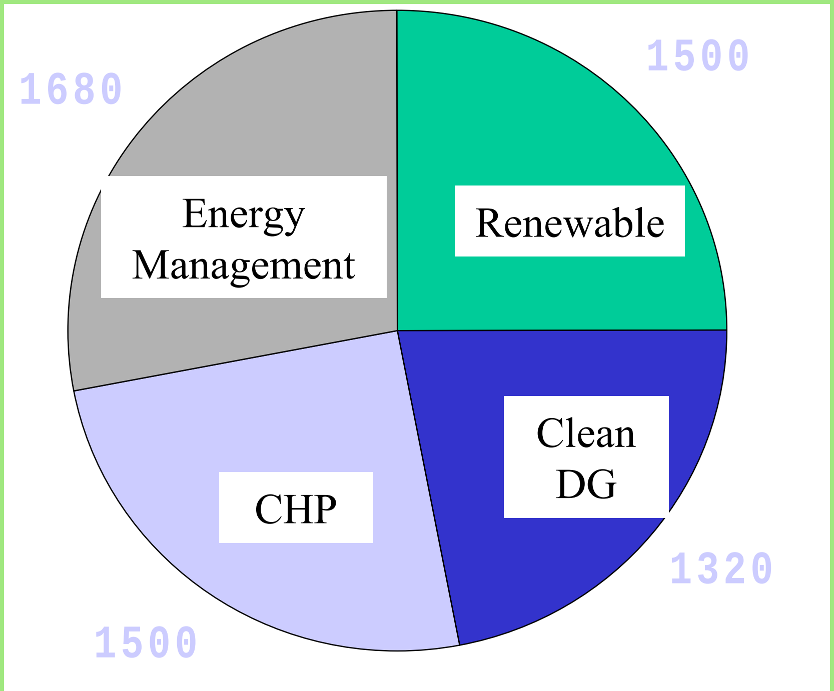
Chicago Energy Plan (2001)

GOALS:

1. Protect Consumers
2. Promote Economic Growth
3. Protect the Environment

STRATEGY:

Use distributed resources, CHP, renewables, and energy management to meet future electrical load growth (6 billion kWh by 2010).



Projected growth over next 10 years (in million kWh)

Source: www.ci.chi.il.us/Environment/html/2001EnergyBook.pdf

Misconceptions About DR/CHP

- *Higher power costs for captive grid residential customers*
    - Answer: DR/CHP only represents a portion of expected growth, and will increase grid utilization and moderate electricity prices.
- *Too much DR/CHP will cause grid instability*
    - Answer: Recent GE study identified virtually no impact up to 20% of total generation; Holland and Denmark using between 40 and 50% DR.
- *DR/CHP is "dirty"*
    - Answer: High-efficiency CHP systems that run on natural gas result in low emissions.

Barriers to Progress

- No standard interconnection terms and conditions
  - Lengthy interconnection approval process
  - Costly fees
  - High interconnection equipment costs
- High standby charges
- Networking limitations
- Other barriers include recognizing the value of DR, high first cost, and lack of familiarity with DR.

ICC Staff Report:

•*“Staff supports policies directed at promoting competition through eliminating the artificial barriers to DR development and utilization.” (p.18)*

Barrier Examples

Example 1:

30 N. LaSalle Street

(1.1 MW Reciprocating Engine for CHP)

- **Issue: Network Interconnection Costs**
  - ComEd generally does not allow parallel interconnection to its downtown radial system network.
  - Adding equipment to isolate system from the network cost over $100,000.
- The network issue creates a barrier to CHP installation in prime downtown buildings, including Lyric Opera, 2 North Riverside, and other similar buildings.
  - Will impede City's ability to meet Energy Plan objectives.

Example 2:

U.S. Army Corps of Engineers (Champaign)

(30 kw Capstone Microturbine (UL Listed))

- **Issue: Interconnection Delay, Cost, Complexity**
  - Initial contact with Illinois Power in October 2001.
  - Interconnection study ($4000) recently done; still waiting for completed interconnection agreement.
    - IP standard agreement is 40 pages; company is working on a shorter agreement for smaller connections.
- **Issue: Standby Charges**
  - Total standby charges estimated at $709 per month summer, $659 per month in winter (IP Rate 22).
    - Includes facilities charge ($375), distribution capacity charge ($42), reactive demand charge ($144), transformation charge ($18).

Example 3:

Hoffer Plastics (South Elgin)

(9 x 800 kw natural gas reciprocating engines)

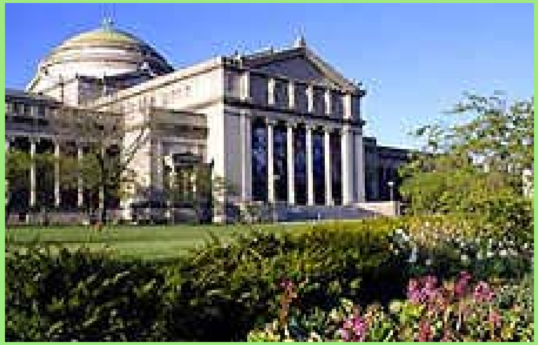
- **Issue: Interconnection Cost**
  - ComEd asserted that a charge was necessary for a $250,000 transfer trip device.
  - Developer had to demonstrate that the device was not necessary (at a cost of $10,000).
  - Interconnection charges eventually totaled approximately $70,000.

Example 4:

Museum of Science and Industry

(1.75 MW natural gas reciprocating engine, with heat recovery)

- **Issue: Interconnection Delay and Cost**
  - ComEd's original six-week estimate for interconnection study required six additional weeks, for a total of three months.
  - Interconnection cost approximately $150,000.
- **Issue: Networking**
  - ComEd agreed to allow this connection to the network (on the 12 kv line) with additional relays that cost $16,000.



Example 5:

Presbyterian Home (Evanston)

(3 x 800kw engines with heat recovery)

- **Issue: Interconnection Delay and Cost**
  - –ComEd required twelve weeks to tell project developer that relay system (which ComEd had approved on seven other projects by same developer) was unacceptable.
  - –Equipment rental prices/confusion:
    - 11/99: Rental rates would increase
    - 01/00: No rent option: either purchase or remove
    - 02/00: OK to rent.

Example 6:

Residential PV System (Southern Illinois)

(1-2 kv photovoltaic panel system)

- **Issue: Interconnection Cost**
  - Illinois Power requested $4,000 to be put in escrow to fund an interconnection study.

Positive CHP Developments in Illinois and Elsewhere

- No exit or CTC fees for CHP and self-generation.
- Peak pricing tariffs that reduce grid congestion.
- Reduction/Elimination of re-negotiated rates.
- FERC’s interconnection ANOPR for small generators up to 20 MW (August 2002).
  - Presumes no impact of DR to the transmission grid when: 1) the project’s export of electricity would not exceed, cumulatively with all other DR on the system, either 15% of peak load on a radial system feeder OR 25% of the minimum load on a network link; AND 2) the project’s capability does not exceed 25% of the maximum short circuit potential.

SOLUTIONS

1. Standard Interconnection Rules and Agreements
   - Timing
   - Fees
   - Application Forms
   - Safety requirements
   - Insurance

Benefits of Standard Interconnection Rules

- Lower transaction costs for generator and transmission owner
- Clear, certain, understandable terms, conditions, procedures
- Faster process
- Little negotiation required
- Reduces role of distribution system owner as obstacle to interconnection

ICC Staff Report: *"Standardized interconnection requirements would facilitate deployment of DR."* (p. 12)

Draft Wisconsin Standards

Category	Interconnection Study Deadline	Distribution System Study Deadline	Application Fee	Interconnection Study Fee
20 kw or less	10 days	10 days	None	None
>20 kw to 200 kw	15 days	15 days	$250	$500
>200 kw to 1 MW	20 days	20 days	$500	cost-based
>1 MW to 15 MW	40 days	60 days	$1000	cost-based

Source: www.renewwisconsin.org/dg/dg1.html

Status of State Standards

- Final Standards:
  - TEXAS:
    - Applicable to 10 MW and smaller facilities.
    - Interconnection required to take place within six weeks of the utility's receipt of a completed request for interconnection.
    - Four week deadline for pre-certified systems.
    - Includes other technical and safety requirements.
    - DR one-stop interconnection guidebook.
  - CALIFORNIA AND NEW YORK ALSO HAVE FINAL STANDARDS.
- Pending state proceedings include: Minnesota, Michigan, Indiana, Wisconsin.

SOLUTIONS

2. Modified Standby Charges

- Most parties agree that standby charges should be cost-based, but challenge is calculating costs.
  - Current standby charges do not reflect the contribution of CHP and other DG to the grid and to the consumer.
    - New clean energy projects reduce peak demand, thereby improve grid utilization and lowering electric grid costs.
    - Installation of distributed energy delays or eliminates the need for expensive utility upgrades to the electric grid.
  - DR may not avoid T&D costs in short run, but in the long run, incremental costs drive rates.

SOLUTIONS

3. Address Network Issues

- Texas interconnection standard requires networking connection for units with inverter-based protection unless the total distributed energy on the feeder represents more than 25% of secondary network load.
- New York City allows interconnection to the power networks without protective devices if the DG supplies only a fraction of the building’s power needs; protective devices are required for greater DG loads or power exports to the network.
- FERC small generator interconnection ANOPR and IEEE 1547 draft standard address network interconnection.

NEXT STEPS

- Expedite adoption of standard interconnection terms and conditions
  - Include networking interconnection issues
- Convene workshops to study:
  - Standby charge issues
  - Tariffs to recognize benefits of CHP and DR

Sources for Barrier Examples

- 30 N. LaSalle Street:
  Thomas Smith
  Vice President - Energy Operations
  Equity Office Properties Trust
  Two North Riverside Plaza - Suite 2100
  Chicago, IL 60606
  (312) 466-3300

- Hoffer Plastics and Presbyterian Homes:
  David Patricoski
  President
  LaSalle Associates, Inc.
  P.O. Box 2878
  Glen Ellyn, IL 60138
  (630) 858-8110

Sources for Barrier Examples

- U.S. Army Corps of Engineers:
  William Taylor
  Engineering Research and Development Center (ERDC)
  Construction Engineering Research Laboratory
  2902 Newmark Dr.
  Champaign, IL 61822-1076
  (217) 352-6511 x6393

- Museum of Science and Industry:
  David Martindale
  Vice President
  Ballard Companies, Inc.
  P.O. Box 5947
  Rockford, IL 61125
  (815) 229-1800

- Residential Solar Panel
  Mary Eileen O'Keefe
  Solar-Gold
  1362 N. State Parkway
  Chicago, IL 60610
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If you have comments or questions . . .

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